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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
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1763	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/805,966	SINGH ET AL.	
	Examiner	Art Unit	
	Luz L. Alejandro	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C:D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,11-25 and 27-32* is/are pending in the application.

4a) Of the above claim(s) *6,22-23* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-9,11-21,24,25 and 27-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 05/18/07 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 7-8, and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Kadomura, U.S. Patent 5,567,268.

Kadomura shows the invention as claimed including a plasma apparatus comprising: a plasma chamber configured to receive a process gas; a radio frequency source 39 configured to resonate radio frequency currents in a radio frequency antenna; a radio frequency antenna including an active antenna (22 or 31) surrounding the plasma chamber and coupled to the RF source and a parasitic antenna (31 or 22) surrounding the plasma chamber and not directly coupled to any RF source; and a

platen 29 for holding a target, wherein electromagnetic fields induced by the radio frequency currents are effective to pass into the plasma chamber and excite and ionize the process gas to generate plasma within the plasma chamber that is tuned by parasitic damping via the parasitic antenna (see figs. 2-3 and their description).

Concerning claims 2-3, note that the active antenna can be considered either the vertically or the horizontally extending coil (22 or 31) depending upon which coil has the RF power applied. Furthermore, note that the parasitic antenna (31 or 22) can be considered either the vertically or the horizontally extending coil depending upon which coil is left open.

Regarding claim 7, note that the inner diameter of each antenna is greater than a size of the target.

With respect to claim 8, note that the parasitic antenna can be considered to be above and coaxial with the active antenna.

Concerning claim 11, the plasma chamber includes: a horizontal planar section 24 positioned above the platen 29; a vertical cylindrical section extending from the horizontal planar section; and a top section 21 coupled to the vertically cylindrical section.

Claims 1-4 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Okumura et al., U.S. Patent 6,875,307.

Okumura et al. shows the invention as claimed including a plasma apparatus comprising: a plasma chamber configured to receive a process gas; a radio frequency

source 104 configured to resonate radio frequency currents in a radio frequency antenna; a radio frequency antenna including an active antenna (106a) surrounding the plasma chamber and coupled to the RF source and a parasitic antenna (106b) surrounding the plasma chamber and not directly coupled to any RF source; and a platen 107 for holding a target, wherein electromagnetic fields induced by the radio frequency currents are effective to pass into the plasma chamber and excite and ionize the process gas to generate plasma within the plasma chamber that is tuned by parasitic damping via the parasitic antenna (see, for example, figs. 1 and 8-11, and their descriptions).

Concerning claims 2-3, note that the active antenna can be considered either the vertically or the horizontally extending coil since it is two-dimensional and extends in both a horizontal and vertical direction. Furthermore, note that the parasitic antenna can also be considered either the vertically or the horizontally extending coil since it is two-dimensional and extends in both a horizontal and vertical direction.

With respect to claim 4, note that the parasitic antenna includes a plurality of turns with one end grounded.

Regarding claim 7, note that the inner diameter of each antenna is greater than a size of the target.

Claims 1-3 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Kadomura, U.S. Patent 6,096,160.

Kadomura shows the invention as claimed including a plasma apparatus comprising: a plasma chamber (51,57) configured to receive a process gas; a radio frequency source 66 configured to resonate radio frequency currents in a radio frequency antenna; a radio frequency antenna including an active antenna 52 surrounding the plasma chamber and coupled to the RF source and a parasitic antenna 53 surrounding the plasma chamber and not directly coupled to any RF source; and a platen 59 for holding a target, wherein electromagnetic fields induced by the radio frequency currents are effective to pass into the plasma chamber and excite and ionize the process gas to generate plasma within the plasma chamber that is tuned by parasitic damping via the parasitic antenna (see figs. 5-6 and their descriptions).

Concerning claims 2-3, note that the active antenna can be considered either the vertically or the horizontally extending coil since it is two-dimensional and extends in both a horizontal and vertical direction. Furthermore, note that the parasitic antenna can also be considered either the vertically or the horizontally extending coil since it is two-dimensional and extends in both a horizontal and vertical direction.

With respect to claim 11, note that Kadomura further discloses a plasma chamber that includes: a horizontal planar section 56 positioned above the platen 59; a vertical cylindrical section extending from the horizontal planar section; and a top section 51 coupled to the vertically cylindrical section.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Sahin et al., U.S. Patent 6,465,051.

Kadomura is applied as above but does not expressly disclose where the parasitic antenna has one of its ends grounded. Sahin et al. discloses grounding an antenna 26 during processing, for example, in order to perform a cleaning process (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to allow for grounding of either of the antennas to allow for more

flexibility when using the apparatus, for example, to allow for efficient cleaning of the apparatus.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Sahin et al., U.S. Patent 6,465,051, as applied to claim 4 above, and further in view of Okumura et al., U.S. Patent 5,888,413.

Kadomura and Sahin et al. are applied as above but do not expressly disclose means for adjusting a number of turns of the parasitic antenna providing a parasitic effect. Okumura et al. discloses means for adjusting the length and the number of turns of a coil (see figs. 20-23 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Sahin et al. so as to allow the coils to have their lengths and turns adjusted as suggested by Okumura et al. because in such a way the plasma density can be effectively controlled and adjusted.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Ishimaru, U.S. Patent 5,681,418.

Kadomura is applied as above but does not expressly disclose wherein at least one antenna is liquid cooled. Ishimaru discloses forming a coil 40 which flows liquid water coolant therethrough (see col. 5-lines 13-21). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made

to modify the apparatus of Kadomura so as to liquid cool the antenna because in such a way overheating of the antenna can be prevented.

Claims 12-13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501.

Kadomura is applied as above but does not expressly disclose wherein the vertical cylindrical section is made of a high quality dielectric, and the top conductive section is made of aluminum and grounded. Collins et al. discloses wherein a vertical cylindrical section 17W is made of a dielectric, and the top conductive section 17T is made of aluminum and grounded (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to comprise the vertically cylinder and top conductive section of Collins et al. because this will allow the improvement of process uniformity.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 as applied to claims 12-13 and 15 above, and further in view of Fitzsimmons et al., U.S. Patent 6,626,188.

Kadomura and Collins et al. are applied as above but do not expressly disclose wherein the ceramic material is one from a list including aluminum nitride. Fitzsimmons et al. discloses having aluminum nitride walls exposed to the plasma within the chamber

(see fig. 3 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. so as to form aluminum nitride in the plasma chamber because in such a way beneficial results will be produced such as the reduction of contamination.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Trow et al., U.S. Patent 5,824,607.

Kadomura is applied as above but do not expressly disclose where the top conductive section is liquid cooled. Trow et al. discloses where a top conductive section is cooled by liquid (see col. 4-lines 40-50). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to cool by liquid because liquid is shown to be an adequate means of cooling a top conductive member of a plasma apparatus.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Kumagai, U.S. Patent 5,916,455.

Kadomura is applied as above but does not expressly disclose a plasma igniter for introducing a strike gas into the plasma chamber to assist in igniting a plasma. Kumagai discloses a plasma igniter 30 for introducing a strike gas into the plasma chamber to assist in igniting a plasma (see fig. 1-2 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time

the invention was made to modify the apparatus of Kadomura so as to comprise a plasma igniter because in such a way plasma will be more easily ignited for processing within the apparatus.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins, U.S. Patent 5,707,486.

Kadomura is applied as above but does not expressly disclose a gas source controller for maintaining a pressure of a plasma chamber at a predetermined value. Collins discloses a controller for controlling the pressure of a plasma chamber (see col. 13-lines 6-20). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to include the controller of Collins to control the pressure of the plasma chamber because such a device would allow for greater controllability over the process performed within the apparatus.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501.

Kadomura is applied as above but does not expressly disclose the RF source operating at a low frequency. Collins et al. discloses a RF source 31 which has a frequency in a range from 100kHz to 100 Mhz (see col. 11-lines 25-40). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to provide the RF

source of Collins et al. because this will allow for the selection of a top source which minimizes damage to sensitive devices and also provides efficient inductive coupling.

Claims 24-25, 27 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607.

Kadomura shows the invention substantially as claimed including a plasma chamber comprising: a horizontal planar section for positioning above a platen; a vertical cylindrical dielectric section 21 extending from the horizontal planar section; and a radio frequency antenna including a horizontally-extending coil 22 positioned proximate to the horizontal planar dielectric section and a vertically-extending coil 31 positioned proximate to the vertical cylindrical dielectric section, the radio frequency antenna including radio frequency currents into the plasma chamber that excite and ionize a process gas so as to generate a plasma in the plasma chamber (see fig. 2 and its description).

Kadomura does not expressly disclose a liquid cooled top conductive section coupled to the vertical section. Collins et al. discloses a plasma chamber comprising a cooled top conductive section 17T coupled to a vertical dielectric section 17W (see fig. 1 and its description). Furthermore, Trow et al. discloses where a top conductive section is cooled by liquid (see col. 4-lines 40-50). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to include a liquid cooled top conductive

section as disclosed by Collins et al. and Trow et al. because in such a way the coupling of the plasma with the wafer will be improved while at the same time having improved controllability of the temperature of the chamber walls.

Concerning claim 25, note that in the apparatus of Kadomura modified by Collins et al. and Trow et al., the top conductive section is grounded (see Collins et al. at col. 21-lines 60-67).

With respect to claim 31, note that in the apparatus of Kadomura modified by Collins et al. and Trow et al. the horizontally extended coil 22 is capable of being coupled to an RF source.

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607 as applied to claims 24-25, 27, and 31 above, and further in view of Sahin et al., U.S. Patent 6,465,051.

Kadomura, Collins et al., and Trow are applied as above but does not expressly disclose where the parasitic antenna has one of its ends grounded. Sahin et al. discloses grounding an antenna 26 during processing, for example, in order to perform a cleaning process (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. and Trow so as to allow for grounding of either of the antennas to allow for more flexibility when using the apparatus, for example, to allow for efficient cleaning of the apparatus.

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501, Trow et al., U.S. Patent 5,824,607, and Sahin et al., U.S. Patent 6,465,051, as applied to claim 28 above, and further in view of Okumura et al., U.S. Patent 5,888,413.

Kadomura, Collins et al. Trow, and Sahin et al. are applied as above but do not expressly disclose means for adjusting a number of turns of the parasitic antenna providing a parasitic effect. Okumura et al. discloses means for adjusting the length and the number of turns of a coil (see figs. 20-23 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. Trow, and Sahin et al. so as to allow the coils to have their lengths and turns adjusted as suggested by Okumura et al. because in such a way the plasma density can be effectively controlled and adjusted.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607 as applied to claims 24-25, 27, and 31 above, and further in view of Ishimaru, U.S. Patent 5,681,418.

Kadomura, Collins et al., and Trow et al. are applied as above but do not expressly disclose wherein at least one antenna is liquid cooled. Ishimaru discloses forming a coil 40 which flows liquid water coolant therethrough (see col. 5-lines 13-21).

In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. and Trow et al. so as to liquid cool the antenna because in such a way overheating of the antenna can be prevented.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607 as applied to claims 24-25, 27, and 31 above, and further in view of Kumagai, U.S. Patent 5,916,455.

Kadomura, Collins et al. and Trow et al. are applied as above but do not expressly disclose a strike gas inlet. Kumagai discloses a strike gas inlet (see ignition chamber 30) whereby plasma is ignited and expelled into the inductively coupled plasma chamber (see fig. 1-2 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. and Trow et al. so as to comprise a strike gas inlet because in such a way plasma will be more easily ignited for processing within the apparatus.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Okumura et al., U.S. Patent 5,888,413.

Okumura et al. '307 is applied as above but do not expressly disclose means for adjusting a number of turns of the parasitic antenna providing a parasitic effect.

Okumura et al. '413 discloses means for adjusting the length and the number of turns of a coil (see figs. 20-23 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. '307 so as to allow the coils to have their lengths and turns adjusted as suggested by Okumura et al. '413 because in such a way the plasma density can be effectively controlled and adjusted.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307.

Okumura et al. is applied as above but does not expressly disclose wherein the parasitic antenna is above and coaxial with the active antenna. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the position of the parasitic antenna and the active antennas based upon a variety of factors including the desired plasma density distribution and such limitation would not lend patentability to the instant application absent a showing of unexpected results. Furthermore, rearrangement of parts has been held to have been obvious.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Ishimaru, U.S. Patent 5,681,418.

Okumura et al. is applied as above but does not expressly disclose wherein at least one antenna is liquid cooled. Ishimaru discloses forming a coil 40 which flows liquid water coolant therethrough (see col. 5-lines 13-21). In view of this disclosure, it

would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. so as to liquid cool the antenna because in such a way overheating of the antenna can be prevented.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Kadomura, U.S. Patent 5,567,268.

Okumura et al. is applied as above but does not expressly disclose where the plasma chamber includes: a horizontal planar section positioned above the platen; a vertical cylindrical section extending from the horizontal planar section; and a top section coupled to the vertically cylindrical section. Kadomura discloses a plasma chamber that includes: a horizontal planar section 24 positioned above the platen 29; a vertical cylindrical section extending from the horizontal planar section; and a top section 21 coupled to the vertically cylindrical section (see fig. 2 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. so as to include the plasma chamber structure of Kadomura because such a structure will allow for the high intensity plasma to be produced remotely from the substrate.

Claims 12-13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Kadomura, U.S. Patent 5,567,268, as applied to claim 11 above, and further in view of Collins et al., U.S. Patent 5,556,501.

Okumura et al. and Kadomura are applied as above but do not expressly disclose wherein the vertical cylindrical section is made of a high quality dielectric, and the top conductive section is made of aluminum and grounded. Collins et al. discloses wherein a vertical cylindrical section 17W is made of a dielectric, and the top conductive section 17T is made of aluminum and grounded (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. modified by Kadomura so as to comprise the vertically cylinder and top conductive section of Collins et al. because this will allow the improvement of process uniformity.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Kadomura, U.S. Patent 5,567,268 and Collins et al., U.S. Patent 5,556,501 as applied to claims 12-13 and 15 above, and further in view of Fitzsimmons et al., U.S. Patent 6,626,188.

Okumura et al., Kadomura and Collins et al. are applied as above but do not expressly disclose wherein the ceramic material is one from a list including aluminum nitride. Fitzsimmons et al. discloses having aluminum nitride walls exposed to the plasma within the chamber (see fig. 3 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. modified by Kadomura and Collins et al. so as to form aluminum nitride in the plasma chamber because in such a way beneficial results will be produced such as the reduction of contamination.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Kadomura, U.S. Patent 5,567,268, as applied to claim 11 above, and further in view of Trow et al., U.S. Patent 5,824,607.

Okumura et al., and Kadomura are applied as above but do not expressly disclose where the top conductive section is liquid cooled. Trow et al. discloses where a top conductive section is cooled by liquid (see col. 4-lines 40-50). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. modified by Kadomura so as to cool by liquid because liquid is shown to be an adequate means of cooling a top conductive member of a plasma apparatus.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Kumagai, U.S. Patent 5,916,455.

Okumura et al. is applied as above but does not expressly disclose a plasma igniter for introducing a strike gas into the plasma chamber to assist in igniting a plasma. Kumagai discloses a plasma igniter 30 for introducing a strike gas into the plasma chamber to assist in igniting a plasma (see fig. 1-2 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. so as to comprise a plasma igniter because in such a way plasma will be more easily ignited for processing within the apparatus.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Collins, U.S. Patent 5,707,486.

Okumura et al. is applied as above but does not expressly disclose a gas source controller for maintaining a pressure of a plasma chamber at a predetermined value. Collins discloses a controller for controlling the pressure of a plasma chamber (see col. 13-lines 6-20). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. so as to include the controller of Collins to control the pressure of the plasma chamber because such a device would allow for greater controllability over the process performed within the apparatus.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al., U.S. Patent 6,875,307 in view of Collins et al., U.S. Patent 5,556,501.

Okumura et al. is applied as above but does not expressly disclose the RF source operating at a low frequency. Collins et al. discloses a RF source 31 which has a frequency in a range from 100kHz to 100 Mhz (see col. 11-lines 25-40). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Okumura et al. so as to provide the RF source of Collins et al. because this will allow for the selection of a top source which minimizes damage to sensitive devices and also provides efficient inductive coupling.

Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160.

Kadomura is applied as above but does not expressly disclose that an inner diameter of each antenna is greater than the size of the target, and wherein the parasitic antenna is above and coaxial with the active antenna. Concerning the inner diameter of each antenna, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum diameter of the antenna based upon a variety of factors including the desired plasma density distribution and such limitation would not lend patentability to the instant application absent a showing of unexpected results. With respect to the location of the parasitic antenna, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the position of the parasitic antenna and the active antennas based upon a variety of factors including the desired plasma density distribution and such limitation would not lend patentability to the instant application absent a showing of unexpected results. Furthermore, rearrangement of parts has been held to have been obvious.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Ishimaru, U.S. Patent 5,681,418.

Kadomura is applied as above but does not expressly disclose wherein at least one antenna is liquid cooled. Ishimaru discloses forming a coil 40 which flows liquid water coolant therethrough (see col. 5-lines 13-21). In view of this disclosure, it would

have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to liquid cool the antenna because in such a way overheating of the antenna can be prevented.

Claims 12-13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Collins et al., U.S. Patent 5,556,501.

Kadomura is applied as above but do not expressly disclose wherein the vertical cylindrical section is made of a high quality dielectric, and the top conductive section is made of aluminum and grounded. Collins et al. discloses wherein a vertical cylindrical section 17W is made of a dielectric, and the top conductive section 17T is made of aluminum and grounded (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to comprise the vertically cylinder and top conductive section of Collins et al. because this will allow the improvement of process uniformity.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Collins et al., U.S. Patent 5,556,501 as applied to claims 12-13 and 15 above, and further in view of Fitzsimmons et al., U.S. Patent 6,626,188.

Kadomura and Collins et al. are applied as above but do not expressly disclose wherein the ceramic material is one from a list including aluminum nitride. Fitzsimmons

et al. discloses having aluminum nitride walls exposed to the plasma within the chamber (see fig. 3 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. so as to form aluminum nitride in the plasma chamber because in such a way beneficial results will be produced such as the reduction of contamination.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Trow et al., U.S. Patent 5,824,607.

Kadomura is applied as above but do not expressly disclose where the top conductive section is liquid cooled. Trow et al. discloses where a top conductive section is cooled by liquid (see col. 4-lines 40-50). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to cool by liquid because liquid is shown to be an adequate means of cooling a top conductive member of a plasma apparatus.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Kumagai, U.S. Patent 5,916,455.

Kadomura is applied as above but does not expressly disclose a plasma igniter for introducing a strike gas into the plasma chamber to assist in igniting a plasma. Kumagai discloses a plasma igniter 30 for introducing a strike gas into the plasma chamber to assist in igniting a plasma (see fig. 1-2 and their descriptions). In view of

this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to comprise a plasma igniter because in such a way plasma will be more easily ignited for processing within the apparatus.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Collins, U.S. Patent 5,707,486.

Kadomura is applied as above but does not expressly disclose a gas source controller for maintaining a pressure of a plasma chamber at a predetermined value. Collins discloses a controller for controlling the pressure of a plasma chamber (see col. 13-lines 6-20). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to include the controller of Collins to control the pressure of the plasma chamber because such a device would allow for greater controllability over the process performed within the apparatus.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 6,096,160 in view of Collins et al., U.S. Patent 5,556,501.

Kadomura is applied as above but does not expressly disclose the RF source operating at a low frequency. Collins et al. discloses a RF source 31 which has a frequency in a range from 100kHz to 100 Mhz (see col. 11-lines 25-40). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the

invention was made to modify the apparatus of Kadomura so as to provide the RF source of Collins et al. because this will allow for the selection of a top source which minimizes damage to sensitive devices and also provides efficient inductive coupling.

Response to Arguments

Applicant's arguments filed 05/18/07 have been fully considered but they are not persuasive. Applicant argues that the antenna mentioned in Kadomura as being the parasitic antenna will not be the parasitic antenna because it does not perform the same function as the parasitic antenna of the instant invention. However, the examiner believes that the parasitic antenna of Kadomura will perform the same function as in the instant application, and no secondary evidence has been provided by the applicant to show otherwise. Either of the antennas in Kadomura can be considered parasitic because they have switches that enable the antenna to be not connected to the RF power supply (making this antenna parasitic), while the other antenna can be connected to the RF power supply and be an active antenna (see figs. 2-3), thereby allowing the plasma chamber to be tuned by parasitic damping via the parasitic antenna and disclosing the claimed invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-

1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Luz L. Alejandro
Primary Examiner
Art Unit 1763

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